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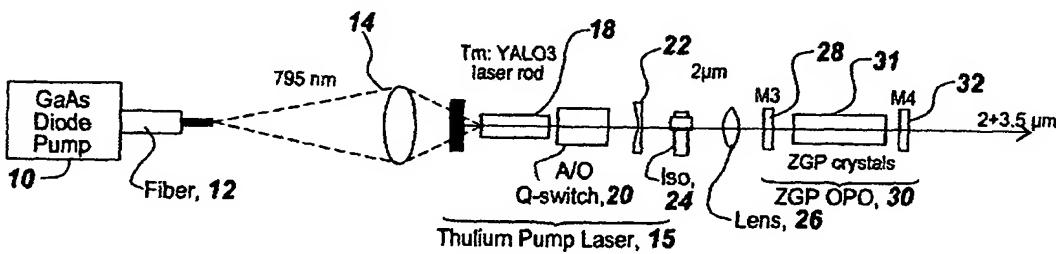
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(54) Title: THULIUM LASER PUMPED MID-IR SOURCE WITH BROADBANDED OUTPUT



(57) Abstract: A Thulium laser (15) is used to directly drive a ZnGeP₂ optical parametric oscillator (30) with a nominal 2 μm output to generate the 3-5 micron wavelengths. In one embodiment, the ZGP OPO is configured as a linear resonator and in another embodiment the ZGP OPO is configured as a ring resonator. The ring resonator prevents optical feedback to the Thulium laser (15) and eliminates the need for an optical isolator (24). Moreover, the Thulium laser pump (15) is implemented as a Tm:YAlO₃ laser in which YAlO is the host for the Thulium YAlO is particularly beneficial as it is a mechanically hard optical material allowing high thermal loading without fracture as well as natural birefringence that can minimize thermal birefringence losses. A longer wavelength transition at 1.99 microns is selected to minimize nonlinear crystal loss. More particularly, a high power, high efficiency Tm:YAlO₃ laser repetitively Q-switched at 10 kHz is used to drive a ZnGeP₂ OPO. The system is run with room temperature components and achieves over 3 W at 3-5 microns with an efficiency of 5% starting from the pump diode. A two crystal resonator (40, 42) design allows tuning over multiple spectral peaks or alternately as an ultra broad spectral source.

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